

REMARKS

Claims 7, 14, 22-24, 26, 28-31, 47, and 48 have been amended, claims 6, 20, and 21 have been cancelled, and new claim 49 has been added. Thus, claims 2-4, 7-19, 22-33, and 45-49 are pending in the present application. The claim amendments and new claim are supported by the specification and claims of the application as originally filed, with no new matter being added. Accordingly, favorable reconsideration of the pending claims is respectfully requested.

1. Claim Objections

Claim 21 was objected to as being of improper dependent form for failing to further limit the subject matter of a previous claim. Claim 21 has been cancelled, so the objection to claim 21 is now moot. Applicants note that the subject matter of new claim 49 substantially corresponds to claim 21 rewritten in independent form.

2. Rejections Under 35 U.S.C. §112

Claims 48, 20, 26, and 28 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for the reasons stated on page 2 of the Office Action.

Claim 48 has been amended to depend from claim 47 since claim 1 was previously cancelled. Claim 20 has been amended to delete the phrases that the Examiner found objectionable. Claim 26 has been amended to add the term "the" as suggested by the Examiner. Claim 28 has been amended in light of the Examiner's comment with respect to the term "etches" and to clarify this claim.

Accordingly, Applicants respectfully request that the rejection of claims 48, 20, 26, and 28 under 35 U.S.C. § 112, second paragraph, be withdrawn.

3. Rejections Under 35 U.S.C. § 102

Claims 47, 45, and 46 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,748,134 to Holland et al. (hereafter "*Holland*") for the reasons set forth on page 3 of the Office Action. Applicants respectfully traverse.

Independent claim 47 has been amended to recite the limitation of forming spacers in the masking substrate. There is no teaching or suggestion in *Holland* of formation of spacers in the masking layers disclosed therein. Accordingly, claim 47 as well as dependent claims 45 and 46 are not anticipated by *Holland*.

Applicants therefore respectfully request that the rejection of claims 47, 45, and 46 under 35 U.S.C. § 102(b) be withdrawn.

Claims 47, 45, 46, 11, 13, 15-17, 20, 26-28, 30, and 31 have been rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,869,385 to Tang et al. (hereafter "*Tang*") for the reasons set forth on pages 3-4 of the Office Action. Applicants respectfully traverse.

As discussed above, independent claim 47 has been amended to recite the limitation of forming spacers in the masking substrate. There is no teaching or suggestion in *Tang* of formation of spacers in the patterned layer disclosed therein. Accordingly, claim 47 as well as dependent claims 45, 46, 11, 13, and 15-17 are not anticipated by *Tang*.

Further, independent claim 20 has been cancelled so the rejection of this claim over *Tang* is now moot. Claims 26-28, 30, and 31 have been amended to depend from new independent claim 49, which recites forming a spacer. Accordingly, claims 26-28, 30, and 31 are not anticipated by *Tang*.

Accordingly, for the foregoing reasons, Applicants respectfully request that the rejection of claims 47, 45, 46, 11, 13, 15-17, 20, 26-28, 30, and 31 under 35 U.S.C. § 102(e) be withdrawn.

4. Rejections Under 35 U.S.C. § 103

Claims 14, 18, 19, and 29 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Tang* for the reasons set forth on page 4 of the Office Action. Applicants respectfully traverse.

Claims 14, 18, and 19 depend from claim 47 and thus include the limitations thereof. As discussed above with respect to claim 47, there is no teaching or suggestion in *Tang* of formation of spacers in the patterned layer disclosed therein. Further, claim 29 has been amended to depend from new independent claim 49, which recites forming a spacer.

In addition, although *Tang* mentions that the ions can be implanted with an “angled implant” (col. 7, lines 2-3), there is no teaching or suggestion that the ions are implanted in a direction that is “within ten degrees from a direction that is orthogonal to the top surface” as recited in claims 14 and 29. The choice of implant inclination angle would not have been a matter of routine optimization since a large number of implant angles beyond 10 degrees could be selected, which would require undue experimentation to produce the claimed invention.

Accordingly, for these reasons, claims 14, 18, 19, and 29 would not have been obvious over *Tang*, and Applicants respectfully request that the rejection of these claims under 35 U.S.C. § 103(a) be withdrawn.

Claims 6-10, 21-25, 32, and 33 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Tang* in view of the article by Minegishi et al. (hereafter "*Minegishi*") for the reasons set forth on pages 4-5 of the Office Action. Applicants respectfully traverse.

Limitations similar to those of cancelled claim 6 have been added to present independent claim 47, and claims 7-10 now depend from claim 47. Claim 21 has been cancelled and claims 22-25 now depend from claim 49.

While *Minegishi* teaches formation of a spacer (frame) in a selective oxidation process, there is no teaching or suggestion that such a spacer would be suitable for use in the process disclosed in *Tang*. It is an improper hindsight reconstruction to combine elements from two different prior art references to achieve the claimed invention without any motivation for doing so other than Applicants' disclosure.

Independent claims 32 and 49 recite that silicon ions are implanted into the substrate. In contrast, *Minegishi* only discloses that boron ions are implanted for channel stopper after the framed mask fabrication step (page 56, col. 1). It is well known that boron ions are electrically conducting, whereas silicon ions are non-electrically conducting (*see Tang*, col. 6, lines 58-62). Further, claim 47 recites that the ions do not alter the electrical charge characteristics of the semiconductor material. Thus, there is no suggestion that the process of *Minegishi*, which uses boron ion implantation, would be suitable to achieve the claimed methods.

Accordingly, for these reasons, claims 6-10, 21-25, 32, and 33 would not have been obvious over *Tang* in view of *Minegishi*, and Applicants respectfully request that the rejection of these claims under 35 U.S.C. § 103(a) be withdrawn.

Claims 2-4 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Tang* in view of Japanese Patent No. 5-175190 (hereafter JP '190) for the reasons set forth on page 5 of the Office Action. Applicants respectfully traverse.

Claims 2-4 depend from claim 47 and thus include the limitations thereof. As discussed above with respect to claim 47, there is no teaching or suggestion in *Tang* of formation of spacers in the patterned layer disclosed therein. In addition, there is no teaching or suggestion in JP '190 of the formation of spacers in the patterned film disclosed therein.

Accordingly, claims 2-4 would not have been obvious over *Tang* in view of JP '190, and Applicants respectfully request that the rejection of these claims under 35 U.S.C. § 103(a) be withdrawn.

Claim 12 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Tang* in view of Japanese Patent No. 62-48028 (hereafter JP '028) for the reasons set forth on page 5 of the Office Action. Applicants respectfully traverse.

Claim 12 depends indirectly from claim 47 and thus includes the limitations thereof. As discussed above with respect to claim 47, there is no teaching or suggestion in *Tang* of formation of spacers in the patterned layer disclosed therein. In addition, there is no teaching or suggestion in JP '028 of the formation of spacers.

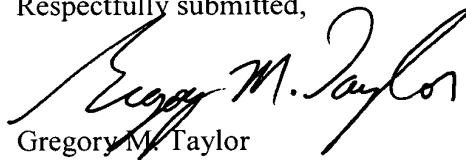
Accordingly, claim 12 would not have been obvious over *Tang* in view of JP '028, and Applicants respectfully request that the rejection of claim 12 under 35 U.S.C. § 103(a) be withdrawn.

CONCLUSION

In view of the foregoing, Applicants respectfully request favorable reconsideration and allowance of the present claims. In the event there remains any impediment to allowance of the claims, which could be clarified in a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney.

Dated this 12th day of September 2002.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW THE CHANGES MADE

IN THE CLAIMS:

Claims 7, 14, 22-24, 26, 28-31, 47, and 48 have been amended as follows:

7. (Thrice Amended) A method as recited in Claim [6] 47, wherein said forming spacers further comprises:

depositing a layer of spacer material over the opening in the masking substrate;
and

etching the layer of spacer material to form the spacers around the [unmasked] opening.

14. (Four Times Amended) A method as recited in Claim 47, wherein said first semiconductor material has a top surface, and wherein said implantation ions are directed towards said first semiconductor material in a direction that is within ten degrees from a direction that is orthogonal to the top surface.

22. (Thrice Amended) A method as recited in Claim [21] 49, wherein said forming a spacer around the opening in the hard mask comprises:

depositing a layer of spacer material over the opening in the hard mask; and
anisotropically etching the layer of spacer material at the opening in the hard mask to form the spacer situated around the opening of the hard mask.

23. (Twice Amended) A method as recited in Claim [21] 49, wherein the spacer around the opening in the hard mask comprises silicon nitride.

24. (Thrice Amended) A method as recited in Claim [21] 49, wherein the spacer is one of a pair of spacers, the ions being implanted in between but not through the pair of spacers and past the hard mask into the exposed region of the volume of silicon, and wherein the exposed region is situated between the pair of spacers, whereby the silicon dioxide is not substantially formed underneath the pair of spacers.

26. (Thrice Amended) A method as recited in Claim [20] 49, further comprising forming a pad oxide layer upon the volume of silicon prior to forming [a] the hard mask over [a] the volume of silicon of [a] the substrate assembly, the hard mask being formed upon the pad oxide layer, and said forming a hard mask over a volume of silicon of a substrate assembly comprising:

forming the hard mask upon the pad oxide layer; and

forming a photoresist mask over the hard mask; and wherein silicon dioxide is formed in the volume of silicon at the region beneath the opening in the hard mask.

28. (Twice Amended) A method as recited in Claim 26, wherein said forming an opening in the hard mask comprises etching through the hard mask [also etches through] and the pad oxide layer.

29. (Thrice Amended) A method as recited in Claim [20] 49, wherein the exposed region of a volume of silicon has a top surface, and said bombarding the exposed region of the volume of silicon with silicon ions through the opening in the hard mask is conducted such that the direction that the ions are implanted into the exposed region is within ten degrees from a direction that is orthogonal to the top surface.

30. (Thrice Amended) A method as recited in Claim [20] 49, wherein said oxidizing the volume of silicon to form silicon dioxide [substantially only at the exposed region by exposure of the exposed region to oxygen] further comprises heating the substrate assembly while exposing the substrate assembly to oxygen.

31. (Thrice Amended) A method as recited in Claim [20] 49, wherein the volume of silicon comprises monocrystalline silicon having a lattice structure, and wherein the implanted silicon ions in the monocrystalline silicon cause the lattice structure of the monocrystalline silicon to become partially randomized at the exposed region into which the ions are implanted.

47. (Once Amended) A method for forming an oxide region on a substrate assembly, the method comprising:

providing a substrate assembly having a first semiconductor material and a masking substrate thereover, wherein said masking substrate comprises at least one [an] unmasked opening that has an opening width, such that said unmasked opening is defined by a masking substrate-free region on said substrate assembly, wherein said masking substrate-free region has a width that is said opening width;

forming spacers in said masking substrate, wherein said unmasked opening is defined by said spacers, and each of said spacers extends from the substrate assembly to contact said masking substrate;

selecting ions to be implanted into said first semiconductor material as implantation ions, wherein said selecting is performed such that said ions do not alter the electrical charge characteristics of said first semiconductor material, and such that said masking substrate is impermeable to said ions;

bombarding through said unmasked opening said first semiconductor material with implantation ions to produce an implanted region; and

forming an oxide of said first semiconductor material [of substantially uniform thickness] throughout said opening width by exposing said implanted region to a gas

phase oxidant, wherein said bombarding and said exposing are performed through said unmasked opening, and said bombarding and said exposing are performed over the entire opening width of said unmasked opening, and no additional layer is formed within said unmasked opening after said bombarding and prior to said forming an oxide.

48. (Once Amended) A method as recited in Claim [1] 47, wherein said implantation ions are ions of said first semiconductor material.